



# **GLENN PROCEDURAL REQUIREMENTS**

**Directive: GLPR 8730.6F**  
Effective Date: **05/10/2021**  
Expiration Date: **05/10/2026**

## **COMPLIANCE IS MANDATORY**

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**Responsible Office: CO/Logistics and Technical Information Division  
Control of Measuring and Test Equipment (MTE) w/Change 1  
(07/06/2022)**

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## **Preface**

### **P.1 PURPOSE**

This Glenn Procedural Requirements (GLPR) document establishes process requirements to control measurement quality for programs, projects, and other applications at the Glenn Research Center (GRC) Lewis Field (LF) and Neil A. Armstrong Test Facility (GRC-ATF) which include calibration and maintenance of inspection, measuring, and test equipment (MTE).

### **P.2 APPLICABILITY**

- a. This GLPR is applicable to all organizational elements at GRC LF and GRC-ATF that own and use MTE.
- b. This GLPR is applicable to documents developed or revised after the effective date of this procedural requirements document.
- c. In this directive, all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The terms “may” denotes a discretionary privilege or permission, “can” denotes statements of possibility or capability, “should” denotes a good practice and is recommended, but not required, “will” denotes expected outcome, and “are/is” denotes descriptive material.
- d. In this GLPR, all document citations are assumed to be the latest version, unless otherwise noted.
- e. All references throughout this GLPR to the “GMCL” refer to the Glenn Metrology and Calibration Laboratory.

### **P.3 AUTHORITY**

NPR 8735.2 Hardware Quality Assurance Program Requirements for Programs and Projects

### **P.4 APPLICABLE DOCUMENTS AND FORMS**

- a. NASA Procedural Requirement (NPR) 1441.1, NASA Records Management Program Requirements
- b. NPR 4300.1, NASA Personal Property Disposal Procedural Requirements
- c. NPR 7150.2, NASA Software Engineering Requirements
- d. NPR 8735.2 Hardware Quality Assurance Program Requirements for Programs and Projects

- e. GLPR 1410.1, Glenn Directives Management
- f. Glenn Work Instruction (GLWI)-CO-8730.032, MTE Recall and (Out of Tolerance) Impact Analysis Surveillance
- g. NASA Technical Standard, NASA-STD-8739.12, Metrology and Calibration
- h. NASA Handbook (HDBK) 8739.19-3, NASA Measurement Quality Assurance Handbook Annex 3: Measurement Uncertainty Analysis Principles and Methods
- i. GRC 57 Form, Calibration Interval Change Request
- j. GRC 282 Form, Out-of-Tolerance Impact Analysis
- k. Aerospace Standards (AS) 9100

## **P.5 MEASUREMENT/VERIFICATION**

- a. Organizations ensure that any program/project requirements for MTE are established, reviewed, and assessed for compliance to this GLPR.
- b. The recall and the out-of-tolerance (OOT)/impact analysis (IA) processes are monitored and maintained by the Logistics and Information Technology Division (LTID) in accordance with GLWI-CO-8730.032.
- c. A verification of compliance to this GLPR is accomplished through the GRC Quality Management System (QMS) internal audits program.
- d. Audit results are documented, tracked, and periodically reported to Center management.

## **P.6 CANCELLATION**

This GLPR cancels GLPR 8730.6D, Control of Inspection, Measuring, and Test Equipment, dated March 28, 2014.

**LAURENCE SIVIC** *Digitally signed by LAURENCE SIVIC*  
*Date: 2021.05.10 08:36:23 -04'00'*

Laurence A. Sivic  
Associate Director

# CHAPTER 1: General Requirements

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## 1. Introduction

Metrology is the science of measurement and has traditionally focused on the calibration of instruments. Although instrument calibration is vital, it is only a part of the process that assures quality in user's measurement data. For example, measurements made in research can influence the fundamental premises that establish the design parameters which flow to the manufacturing processes and eventually impact the final product. Because a breakdown can occur anywhere within this cycle, measurement quality assurance has to be integrated into every part of the lifecycle process from the basic research to the final product inspection process. The Control of Measuring and Test Equipment (MTE) program is imperative to ensure the soundness of measurement quality, which impacts safety and mission assurance and provides a cost benefit to the government.

### 1.1 Goal

The goal of this GLPR is to provide requirements, methods, and guidance to achieve compliance with NASA policy and AS9100, thereby providing accurate measuring and test equipment for users supporting the programs and missions at GRC.

### 1.2 Quality and Safety (Q&S) Functions and Conditions Requiring Measurement Controls

**1.2.1** Testing, qualification, certification, and/or acceptance measurements of flight hardware, ground support equipment, test systems, or other flight-related products.

**1.2.2** Measurements essential to the safety of personnel and the public or for the protection of Government or private property, including hazardous and/or critical applications, as defined in (reference).

**1.2.3** Operation of telecommunications and transmission systems where signal interfaces and circuit confirmations are essential to mission success.

**1.2.4** Research and technology development, manufacturing, inspection, testing, operations, maintenance, support, or other applications where the accuracy of measurements is essential to achieve mission success.

**1.2.5** NASA publications or other documents released for external review whose conclusions/recommendations depend upon the accuracy of measurement results and that impact the safety or success of NASA missions. Excluded are preliminary research papers and research instruments under development that have not had traceable units of measurement established.

**1.2.6** Physical measurements used to apportion, levy, or otherwise assign cost(s), or ensure local, state, or federal regulatory compliance.

*Note: The MTE that is not mandated for calibration in Section 1.3 may be managed through the recall process at the technical contacts' or users' request, utilizing the GMCL customer interface. The MTE in this category are subject to the applicable requirements outlined in this document to ensure sound quality practices throughout the site.*

### **1.3 Calibration Service**

**1.3.1** All calibrations performed for NASA Glenn shall be performed by qualified calibration suppliers as listed on the Qualified Calibration Suppliers List. The GMCL is a NASA-qualified calibration supplier that meets this requirement.

- a. It is the responsibility of the GMCL to verify that outside, third-party calibration suppliers meet NASA requirements and maintain the Qualified Calibration Suppliers List in accordance with their work instruction.
- b. The MTE calibration technical contacts shall ensure all third-party calibration service providers are on the Qualified Calibration Suppliers List before independently arranging calibration of any MTE. If a calibration supplier is needed, but is not on the GMCL's Qualified Supplier List, the GMCL should be notified to initiate and complete the qualification process in order to add them to the list prior to using that service provider as a calibration source.

*Note: The qualified suppliers are only qualified for specific measurement disciplines. A review may be needed if additional measurement disciplines are needed that are not currently qualified.*

**1.3.2** If calibration is performed by Center personnel, it is the responsibility of the technical contact's organization to ensure it is done according to minimum requirements in this document for NASA calibration and that personnel are properly trained for the task.

**1.3.3** Due to the unique nature of some MTE used at GRC, an approved qualified calibration supplier may not be possible. A government representative shall have the authority to approve a nonqualified supplier after it has been determined that sourcing a qualified calibration supplier is not possible.

- a. If approved, this source shall also be approved for the post-test calibration of that MTE.
- b. This decision and support information shall be documented in the GMCL database.
- c. This decision will only be for the immediate application and shall be reevaluated for any other MTE.

### **1.4 Calibration and Mandatory Recall**

**1.4.1** All MTE used directly for quality and/or safety measurements shall be calibrated and placed on mandatory recall.

**1.4.2** The MTE that is not in calibration cannot be used for quality or safety measurements, as required by Section 1.2, and shall be removed from service until calibration is performed.

**1.4.3** All calibration events of MTE used for quality and safety shall be recorded in the GMCL database.

**1.4.4** If calibration is performed by an entity other than the GMCL, the technical contact or user of the MTE shall provide all appropriate documentation of that calibration event (calibration certificates, calibration data, etc.) necessary to record the calibration event to the GMCL.

**1.4.5** The person initiating the MTE work requests in the Glenn metrology web interface shall ensure that quality and safety MTE is properly identified as quality and safety using the work request process.

**1.4.6** Recall notification shall be sent to the technical contact of the MTE on a weekly basis. This recall notification will encompass MTE registered in the GMCL database due calibration in no less than 60 days before the date of the calibration. Recall reminders will be sent to recall authority and their next level of management in no less than seven (7) days before calibration is due. Notifications will continue until the status is changed in the GMCL database.

**1.4.7** The recall notification shall be acted upon *before* the MTE is due calibration to mitigate corrective action within the process requirements in GLWI-CO-8730.032.

**1.4.8** If action to calibrate, remove of recall, or extend the interval is not taken within 14 days past the due date, LTID shall generate a corrective and preventive action (CAPA) in the Corrective and Preventive Action (CPAR) System against the nonconforming division on the 15<sup>th</sup> day.

**1.4.9** Objective evidence of this action shall be communicated to the GMCL to prevent the issuance of a CAPA.

**1.4.10** The GMCL shall maintain the recall notification process and keep records of recall activities.

**1.4.11** Users of non-quality and non-safety MTE may place their MTE in the recall process to improve the management of the overall equipment population onsite.

**1.4.12** Calibration performed by the GMCL, third-party calibration suppliers (on or off Center), or by Center personnel, shall meet the NPD requirements of compliance to NPR 8735.2, Hardware Quality Assurance Program Requirements for Programs and Projects, and NASA-STD-8739.12, Metrology and Calibration.

## **1.5 Post Test Calibration**

**1.5.1** The MTE used for quality and/or safety shall be calibrated post-test(s) or when due calibration, in accordance with this document, to ensure in-tolerance measurements were

performed while in use. See 1.5.5 through 1.5.7 for exceptions.

- a. Calibration can be performed before the due date if it is beneficial to ensure critical post-test data is not found to be out-of-tolerance (OOT).
- b. The MTE shall be calibrated at the end of its calibration interval in accordance with this document. If it is determined the criticality of the measurement accuracy mandates calibration at the end of the test, before the MTE is due for calibration, it can be calibrated before the end of its calibration interval.

**1.5.2** The MTE is considered nonconforming if it is found to be OOT when recalibrated, the technical contact shall perform and document an impact analysis (IA) to ensure the OOT MTE did not have a negative impact on the measurements or decisions made using the OOT MTE. The IA process is defined in Chapter 4 of this GLPR.

**1.5.3** The MTE used for quality and safety shall be taken out of use and submitted for calibration at or before its calibration due date to ensure the MTE stays within expected performance parameters. The technical contact or user can initiate an interval extension as outlined in Section 1.8. The MTE can be calibrated prior to its due date at the request of the technical contact or user.

**1.5.4** If it is determined that the measurements made by the MTE are NOT significant by the nature of the application (i.e. – safety equipment previously calibrated for measuring during research but did not incur safety problems arose during testing), then post-use recalibration of that MTE is not mandatory. It should be recalibrated if it will be used for safety critical measurements.

**1.5.5** Calibrated Q&S MTE that was ***not used*** during its calibration interval does not require post-test calibration, or calibration at its due calibration due date, and can be removed from mandatory recall (recalibration) at the discretion of the technical contact or user. Upon calibration expiration, should be placed under control as required by their operational documents and MTE will be required to be recalibrated before any reuse for Q&S purposes.

**1.5.6** The MTE that becomes inoperative during use is not required to be calibrated at the end of its use or at its calibration due date. The technical contact or user shall notify the GMCL that the unit became inoperative during use and should be removed from recall for that reason.

*Note: If the nonfunctioning attribute is critical to the research measurements, or is unrelated to the measurements performed, a repair and calibration may be performed at the request of the technical contact or user.*

## **1.6 The MTE Control**

**1.6.1** The MTE shall be controlled to ensure uncalibrated or inappropriate MTE is not used for measurements where the accuracy of the data requires measurements performed by a calibrated device.

**1.6.2** The MTE that is in calibration shall have a valid calibration label affixed in an easily read location. See Chapter 2 for additional detail regarding labels.

**1.6.3** If an organization uses a method of controlling MTE that varies from this document, the organization shall secure a waiver in accordance with GLPR 1410.1.

**1.6.4** The organization shall have a documented process that ensures positive control of MTE in their respective organizations that encompasses all of the intentions of this document. Such processes, including the MTE label requirements for that area or organization, may be documented by way of organizational work instructions or may be incorporated within other internal documents such as a project's product assurance plan or facility's operating procedure.

**1.6.5** All in use quality and safety MTE that is intermingled with uncalibrated MTE shall be labeled to provide instant visual status as defined by this document.

- a. Any MTE that is not in a valid calibration status with a valid calibration label, shall be labeled "Not Calibrated," "Calibration Not Required," or be stored in an area with prominent signage of the equipment status.
- b. Prominent labeling and/or signage shall communicate that the MTE is/has been shall be calibrated before use or labeled with a "Calibration Not Required" label if removed from this storage. See Chapter 2, Paragraph 2.2.c and 2.2.d for additional label applications.

**1.6.6** The MTE without a label indicating a valid calibration shall be considered not calibrated and not be used for quality and safety measurements.

**1.6.7** Labeling the status of individual instruments that are not in use and are being held in storage areas or cabinets is not required unless the instruments are being stored in close proximity to instruments requiring a valid calibration. Storage areas and/or cabinets should have prominent signage that indicates the calibration status of the instruments if used to store uncontrolled MTE.

**1.6.8** There are three acceptable labels that can be used for MTE that is not in calibration: "Not Calibrated," "Calibration Not Required," and "Cal Before Use."

- a. The "Not Calibrated" label shall be used for MTE overdue calibration that is normally kept in calibration but is not currently in use and is too difficult, dangerous or extremely time consuming to remove from the vicinity of calibrated equipment.
- b. The "Calibration Not Required" label limits MTE to noncritical, non-accuracy and/or nonhazardous measurements, ONLY.
- c. The "Cal Before Use" label shall be applied to devices or systems that require daily calibration or "just-prior-to-use" calibration due to very short-term stability defined by hours not months or years.



**1.6.9** Only one calibration status label shall be affixed to a piece of MTE. It is acceptable to place labels on top of other labels as the calibration status changes or to place it near the instrument to enhance calibration awareness and compliance efforts.

## **1.7 Office of Record**

The GMCL is the office of record for calibration events. Complete documentation for all calibration event information performed for Glenn by third-party calibration suppliers or by user-managed calibrations shall be sent to the GMCL for retention.

## **1.8 Calibration Interval**

**1.8.1** Calibration intervals are established by the GMCL in accordance with their applicable work instruction for MTE calibrated in the GMCL.

**1.8.2** The lengthening of a calibration interval, also known as a “calibration extension,” can be extended by 20 percent of the original cycle only for critical testing which shall continue if MTE in the test goes out of calibration, or if other acceptable practices justify different calibration intervals from what was assigned to that MTE.

**1.8.3** All 20 percent extensions shall be requested prior to, or on the day of, the expiration of the calibration due date of the instrument.

**1.8.4** Only one 20 percent extension is permissible per instrument per calibration cycle. The GRC 57 form process shall be used for calibration extensions greater than 20 percent of the original calibration cycle or if an extension is required after the MTE has gone past its calibration due date.

**1.8.5** The GRC 57 form shall be processed in accordance with the instructions embedded on that form.

**1.8.6** All equipment that has a calibration interval extension shall be calibrated at the end of the extension to ensure the MTE is within specifications. Post-test calibration requirements are found in Section 1.5.

**1.8.7** The GMCL shall be notified of any calibration due date changes or interval extensions to ensure the integrity of the Center metrology database is accurately maintained.

**1.8.8** Permanent calibration interval changes are possible by serial number if approved using the form GRC 57 process to ensure proper methodology is applied and the interval changes will not adversely compromise the application of the instrument.

## **1.9 Non-calibrated Measurement**

Characterization of hardware or mechanical controls (characterizing controls for angle, pitch, etc.) is considered measurement controls and not calibration. This type of characterization is not categorized as calibration and is not covered in this document.

## **1.10 Deviations**

**1.10.1** Any deviations from the requirements in this document shall be approved using the process defined in GLPR 1410.1.

**1.10.2** Organizations or projects that deviate from the requirements of this document shall have documented work instructions and associated documents that meet the intent of this document and are used by that entity to control MTE. Measurement control should be evident if there are any deviations.

**1.10.3** If calibration is impossible (i.e., embedded transducers, thermocouples, no longer accessible for calibration, etc.), best engineering practices should take place.

## **1.11 Organization Responsibilities**

### **1.11.1 The LTID Shall:**

- a. Ensure all MTE processed by the GMCL is calibrated in accordance with NPR 8735.2 and NASA-STD-8739.12. .
- b. Manage the personnel, facilities, equipment, and processes necessary to perform calibration on electrical, gas analyzing, temperature, humidity, dimensional, physical measuring, pressure, flow, and mechanical measuring devices.
- c. Maintain the GRC MTE calibration management database to standardize the method for MTE owners to track the calibration status of MTE that affects quality and safety.
- d. Maintain records of calibration in accordance with NPR 1441.1, NASA Records Management Program Requirements.
- e. Maintain the GMCL for compliance to NASA standards and policies.
- f. Provide and maintain a list of qualified calibration laboratories and calibration suppliers that meet NPR 8735.2 and NASA-STD-8739.12 requirements.
- g. Perform acceptance testing of new MTE purchased for GRC.
- h. Send “Calibration Due Notifications” to MTE technical contacts for all MTE on recall that are due calibration contained in the GRC MTE calibration management database.
- i. Notify MTE users when their as-found calibration data is found OOT. This process requires notification, tracking, and maintenance of the IA process.
- j. Maintain the recall and the OOT/IA processes in accordance with the applicable calibration laboratory work instruction. Provide surveillance/corrective action notification on the MTE

recall notification process and MTE OOT IA process to ensure compliance with this directive.

- k. Initiate corrective action in the CPAR system for MTE technical contacts who do not complete the IA form, Corrective Action Plans and/or the recall notifications, as required in GLWI-CO-8730.032.
- l. Maintain an instrument pool consisting of commonly used MTE available for use by Center personnel.
- m. Assign a unique identifier number to each piece of equipment that passes through the GMCL.
- n. Ensure that MTE accuracy and fitness for use is maintained during its receiving, handling, storage, packaging, preservation, and delivery.
- o. Provide support to the Programs and Projects Assurance Division to ensure compliance with GRC metrology requirements.
- p. Maintain a database of Corrective Action Plans (CAP) for significant IAs. Reviews all IA CAPs to determine if additional actions are required. Provide support to the Programs and Projects Assurance Division to ensure compliance with GRC metrology requirements.

#### **1.11.2 The MTE Technical Contacts and User's Organizations Shall:**

- a. Ensure that all MTE technical contacts and users calibrate quality and safety MTE as defined in NPR 8735.2 and NASA-STD-8739.12 (see Attachment A) and comply with the requirements of this document.
- b. Ensure all calibrations are performed by trained personnel.
- c. Ensure in-situ calibrations are performed in accordance with NPR 8735.2 and NASA Std 8739.12, whether the calibration service provider is the GMCL, onsite personnel, or third-party calibration suppliers brought on Center.
- d. Ensure technical contacts or Users submit calibration interval extension requests prior to the MTE calibration due date.
- e. Ensure deviations from this document have an approved waiver using the documented process found in GLPR 1410.1. All respective organization personnel who use MTE under this deviation shall be trained to all deviation requirements to ensure positive control of MTE in their respective organizations. Such processes may be documented by way of organizational work instructions or be incorporated within other internal documents such as a project's product assurance plan or a facility's operating procedure.
- f. Ensure that all MTE affecting quality and/or safety used by the organization has the appropriate label of calibration in accordance with Chapter 2 of this directive.

- g. Ensure that GRC temporary employees, temporary contractors, visitors, interns, or students, are not assigned or designated as owners of MTE.
- h. Ensure the GMCL is notified via the metrology web interface if the designated recall (ownership) authority changes due to personnel changes in their organization.
- i. Ensure GRC employees screen through the utilization of the GRC MTE calibration database, GRC instrument pool, and federal property databases, as applicable, for the first source of MTE in lieu of new MTE procurements for research and testing at LF and GRC-ATF.
- j. Review their assigned property to identify if property is no longer needed for operational purposes or if it needs to be replaced as required by NPR 4300.1.
- k. Ensure completion of the IA process and submittal of IA forms to GMCL. This includes the completion of all Corrective Action Plans generated by the IA.

### **1.11.3 The MTE Technical Contacts Shall:**

- a. Ensure that all MTE affecting quality and/or safety is in the Glenn MTE calibration management database.
- b. Ensure recall notifications from the GMCL for all MTE are responded to before the expiration due date of the MTE calibration.
- c. Ensure all MTE that affects quality and/or safety, or is determined by the owners' organization to need calibration, is calibrated and properly labeled before use in accordance with Chapter 2 of this directive.
- d. Ensure that all MTE affecting quality and/or safety is identified with a unique identification or tag number.
- e. Ensure all MTE not stored has an evident label that identifies the calibration status.
- f. Ensure all inactive MTE is either stored in a segregated area with labels or signs that prominently display required verification of calibration status before use, or has an explicit label that identifies the calibration status.
- g. Document and ensure that MTE is properly labeled with a limited calibration label noting the extension when the calibration interval has been extended.
- h. Ensure all MTE is sufficient to meet the uncertainty requirements of the projected /planned use. Measurement uncertainty, if required, should be done in accordance with NASA-HDBK 8739.19-3, NASA Measurement Quality Assurance Handbook - Annex 3: Measurement Uncertainty Analysis Principles and Methods.

- i. Route newly purchased quality and safety MTE to the GMCL to ensure acceptance testing is performed.
- j. Ensure the handling, storage, packaging, and preservation of MTE to maintain its accuracy and fitness for use.
- k. Respond to “Calibration Due Notifications” sent out by the GRC MTE calibration management database manager before the item’s calibration expiration date is reached.
- l. Notify the GRC MTE calibration management database manager to add or change relevant database information for all MTE that affects quality or safety.
- m. If technical contact determines a 20 percent calibration interval extension is needed, the technical contact should notify the GMCL. This extension shall only be processed if the interruption for the calibration would significantly impact ongoing tests, research, or projects.
- n. Document adequate justification to extend calibration intervals greater than 20 percent on the GRC 57 form. This form shall be sent to the Safety and Mission Assurance (SMA) Directorate (Code Q) for review and approval. This can include statistical analysis and process controls.
- o. Send all calibration documents to the GMCL for all MTE calibration performed by a third-party supplier or by Glenn personnel for recordkeeping.
- p. Complete IA as described in Chapter 4 when an OOT condition exists for assigned MTE. Technical contacts and the responsible engineer may need to work with the customer to assess impact of any OOT condition.

#### **1.11.4 The MTE Users Shall:**

- a. Ensure that all MTE affecting quality and/or safety has a valid calibration and valid calibration label.
- b. Ensure all MTE that is used for quality and safety applications is identified as quality and safety in the GMCL database. This shall be done if MTE changes from non-quality and non-safety applications to quality and/or safety applications during its calibration cycle.
- c. The user shall notify the GMCL to update the status to quality and safety to ensure the equipment is on Recall.
- d. Ensure that all MTE affecting product quality and/or safety has the measurement uncertainty known and has the required measurement capability to meet the requirements of the projected/planned use.
- e. Ensure that MTE identified with limited calibration or characterization data meets the measurement requirements of the application before use.

- f. Ensure that all newly purchased MTE is routed through the GMCL for acceptance testing.
- g. Ensure all third-party calibration service providers that are used are on the GMCL's Qualified Suppliers List.
- h. For OOT condition, ensure calibration data and IA form is transmitted to the technical contact upon receipt.
- i. Ensure the handling, preservation, and storage of MTE to maintain its accuracy and fitness for use.
- j. Ensure that all instrumentation that does not require calibration which is, or will be, in close proximity to instruments requiring a valid calibration, shall have a "Calibration Not Required" label in accordance with Chapter 2 of this directive.
- k. If user determines a 20 percent calibration interval extension is needed, the user should notify the GMCL no later than the calibration due date. This extension shall only be processed if the interruption for the calibration would significantly impact ongoing tests, research, or projects.
- l. Document adequate justification to extend calibration intervals greater than 20 percent on the GRC 57 form. This form shall be sent to SMA Directorate (Code Q) for review and approval. This can include statistical analysis and process controls.
- m. Ensure that MTE with a broken tamper-resistant label shall be handled in the same manner as test equipment with an expired calibration. Its status should be investigated and appropriate action taken, as necessary, to comply with the requirements of this directive.
- n. Verify, control, and document test software used for measurement and inspection in accordance with NPR 7150.2, NASA Software Engineering Requirements.
- o. Screen for reutilization of MTE using the GRC MTE calibration management database, GRC instrument pool, and federal property databases, as the first source of supply in lieu of new MTE procurements.

#### **1.11.5 The SMA Directorate**

- a. The SMA shall act as a third-party mediator to resolve any MTE safety and/or quality issues.
- b. A verification of compliance to this GLPR shall be accomplished through the GRC QMS audit program.
- c. Audit results shall be documented, tracked, and periodically reported to Center management.
- d. Reviews and authorizes GRC 57 form calibration interval extensions/waivers, as applicable.

#### **1.11.6 Procurement Division**

- a. The Procurement Division shall provide a method via the Systems, Applications, and Products (SAP) and the Purchase-Card Web Solution (P-Card) to identify and correctly communicate MTE metrology information requirements when purchasing new MTE.
- b. Provide a means to identify and route MTE purchases to the GMCL for acceptance testing.

#### **1.11.7 Mission Support and Integration Office**

The Mission Support and Integration Office shall ensure MTE purchase requests contain required information, is routed correctly for approvals, and that procedures are in place to route MTE purchases to the GMCL for acceptance testing.

#### **1.11.8 Project Office Shall**

- a. Support measurement processes to ensure the requirements of this directive are met.
- b. Supply sufficient resources, which include funding and time for calibration to support measurement processes.

# CHAPTER 2. Calibration Labels

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## 2.1 Labeling

2.1.1 The calibration status of all MTE that affects quality and safety shall be clearly identified.

- a. Calibration status labels should be kept current to show the current calibration status of the equipment.
- b. Calibration labels should be affixed to an area that is easily readable, when practical. For MTE that cannot be physically labeled due to the lack of clear surface area, an appropriate method of labeling shall be used (which may include hanging label from MTE, affixing label to MTE packing, affixing a label on an associated rack front panel, etc.).
- c. Labels are not considered permanent since the application of the equipment may change.

2.1.2 All instrumentation that is, or will be, in close proximity to instruments requiring a valid calibration, shall be labeled in accordance with the definitions on Section 2.2 or be removed from the proximate area when practical.

2.1.3 Uncalibrated MTE shall be labeled to show its current status as defined in this document.

2.1.4 All noncalibrated MTE usage is limited to noncritical, non-accuracy sensitive, or nonhazardous measurements. See Chapter 1, Section 1.7 for further information.

2.1.5 All calibrated MTE, where practical, that can be disassembled for adjustment shall have a tamper-resistant label upon reassembling and completion of calibration. If the instrument has an adjustment required for the proper use or set-up, then that type of adjustment should not be covered. If an instrument is too small, or does not have sufficient surface area available for a label, other means of tamper resistance measures can be used (ex. apply glyptol to the potentiometers). If replacing a battery would destroy a tamper proof label, contact GMCL for a replacement label. A label or tamper-resistant method is not required if it is physically impossible to attach.

2.1.6 A calibration label shall have all fields on the label completed and contain:

- a. A unique identifier for that specific device. This could be the serial number, equipment control number, or another tracking number assigned to that specific device.
- b. The date the device was calibrated.
- c. The date the device is due for its next calibration.
- d. Identification of who was responsible for completing the label.



- e. Limits: If there are any limitations from a regular calibration, state calibration parameters that do not meet manufacturer specifications or list the specific parameters that were or were not calibrated, as applicable.

2.1.7 A statement that the device has a limited calibration, if it is not calibrated to meet all of the manufacturer specifications, functions, or that has some special limitations, shall be evident by the MTE labeling and calibration documentation.

2.1.8 Whenever possible, the limits shall be stated on the label. It is strongly recommended that calibration documents are attached or readily accessible to MTE users to ensure the instrument is used appropriately.

## 2.2 Label Categories

The following are acceptable labels and definitions of how they are to be used at GRC that meet the criteria identified in Step 2.1.7.

A blue rectangular label template for 'NASA GRC CALIBRATION'. It features a header with 'NASA GRC' in white on a blue background and 'CALIBRATION' in blue on a white background. Below the header, there are three horizontal lines for 'ID #', 'DATE', and 'DUE'. To the right of these lines is a vertical line labeled 'STAMP'. On the far right, there is a vertical label 'TQ51A-1'.

### a. CALIBRATION

Identifies equipment that has been calibrated to manufacturer's specifications, an applicable federal specification, military specification, or published NASA specification.

A yellow rectangular label template for 'NASA GRC LIMITED CALIBRATION'. It features a header with 'NASA GRC' in black on a yellow background and 'LIMITED CALIBRATION' in yellow on a black background. Below the header, there is a line for 'Limits'. Below that, there are three horizontal lines for 'ID #', 'Date', and 'Due'. To the right of these lines is a vertical line labeled 'Stamp'. On the far right, there is a vertical label 'TQ51A-1'.

### b. LIMITED CALIBRATION

Identifies equipment that has been calibrated to "limited use" specifications. The limitation may be related to accuracy, range, and/or function. The use of this equipment is only when its limitations are known by the user and a copy of its calibration record is available.

A red rectangular label template for 'NASA GRC NOT CALIBRATED'. It features a header with 'NASA GRC' in white on a red background and 'NOT CALIBRATED' in red on a white background. Below the header, there is a line for 'Authority'. Below that, there is a line for 'Date'. On the far right, there is a vertical label 'TQ52B-2-1'.

### c. NOT CALIBRATED

Identifies equipment that is normally kept in calibration but has exceeded its calibration interval, is not currently in use, and is too difficult, dangerous or extremely time consuming to remove from the vicinity of calibrated equipment. This is a temporary label until the equipment can be calibrated or relabeled as calibration not required. Label available for use by lab-wide personnel.

A white rectangular label template for 'CALIBRATION NOT REQUIRED'. It features a header with 'CALIBRATION NOT REQUIRED' in bold black text. Below the header, there is a line for 'Limited to Non-Critical Non-Accuracy Sensitive or Non-Hazardous Measurements'. Below that, there is a line for 'Authority: NASA'.

### d. CALIBRATION NOT REQUIRED

Identifies equipment used in systems where performance is independent of the measure value and is limited to noncritical, non-accuracy sensitive, nonhazardous measurements. A general indication from the measurement device is all that is required. This equipment is not suitable for quality, safety or calibration. Label available for use by lab-wide personnel.

A rectangular label template with a light blue background. At the top, it reads "NASA GRC CAL BEFORE USE". Below this, there are two horizontal lines. The first line is labeled "ID #" on the left and "Stamp" on the right. The second line is labeled "Date" on the left. On the far right, there is a vertical line and the text "TQ576-10-1" oriented vertically.

e. CAL BEFORE USE

Shall be applied to devices or systems that require daily calibration or calibration “just-prior-to-use” instruments, or systems, due to very short term stability defined by hours and not months or years. The calibration procedure, calibration interval, and reference or calibration standards, and objective evidence of calibration performance, will be defined and documented within the approved operating procedure for the equipment. Label available for use by lab-wide personnel.



f. CALIBRATION VOID IF SEAL BROKEN

This is a tamper-resistant label to limit access of critical and/or internal adjustments to maintain calibration integrity. Label controlled by the appropriate GMCL.

## CHAPTER 3. Impact Analysis (IA) - Assessment Impact of Out-of-Tolerance MTE Process

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- 3.1 The GMCL identifies OOT data points from internal or third-party calibration.
- 3.2 The GMCL sends out the GRC 282 form, Out-of-Tolerance Impact Analysis (IA).
  - a. Calibration performed through the GMCL – calibration data and GRC 282 form are returned with the equipment. The GRC 282 form is sent to the technical contact by the initiator.
  - b. User-managed calibration (self cal or outsourced third-party) – GRC 282 form is mailed to the technical contact.
- 3.3 Technical contact reviews OOT data, conducts an assessment of the impact of the OOT condition in relation to test requirements, decisions, and/or conclusions made. Then complete the GRC 282 form.

*Note: See GRC 282 Form, Out-of-Tolerance Impact Analysis, for further instructions.*

- a. For Section 1 on the GRC 282, the technical contact will work with the responsible engineer and customer, as appropriate to determine the level of impact resulting from the OOT. If no impact or insignificant impact, the technical contact and responsible engineer shall sign in the signature box and return original form to the Metrology Lab within 30 days of receipt.
- b. If the impact is “significant” complete the IA in Section 2 on the GRC 282, and the CAP in Section 3 on the same form.
  - (1) An estimated completion date in the CAP shall be provided. Evaluate any impacts to customer conclusions, decisions, and/or reports.
  - (2) Technical contact and responsible engineer shall sign and return the form to the Metrology Lab within 30 days of receipt.
- c. Upon receipt, the metrology lab reviewer signs the form and performs further analysis of the OOT equipment to determine if further action is warranted. The form is returned to the responsible engineer.
- d. Document actual corrective action that was performed in Section 4. If the corrective action cannot be completed by the estimated completion date, notify Metrology Lab via email to provide a new completion date. If the corrective action is not completed by the new date, the Metrology Lab will enter a CAPA in the CPAR system against the technical contact’s organization.
- e. The form is signed by the responsible engineer and sent to their supervisor for review and signature and returned to the GMCL.

3.4 The GMCL shall send out automated notifications weekly to the technical contact on all open IA forms and/or CAPs until they are returned and closed within the system.

3.5 The GMCL shall add the CAP information to its database for tracking and notification purposes

3.6 If the IA form and/or CAP has not been received within seven (7) days of the due date, then the GMCL shall send out a notice to the technical contact and the respective management weekly until closed.

3.7 The GMCL shall update the due date one time for the CAP if notified by the technical contact or responsible engineer prior to the due date with a new target date.

3.8 When the initial IA form and/or the CAP is greater than 15 days overdue, the metrology technical representative shall write a CAPA against the technical contact's organization.

3.9 The GMCL shall provide annual metrics to LTID leadership for dissemination to the appropriate leadership teams.

## CHAPTER 4. MTE Recall Corrective/Surveillance Action Process

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4.1 The GMCL shall process IA form in accordance with GLWI-CO-8730.032, MTE Recall and (Out of Tolerance) Impact Analysis Surveillance, work instruction.

4.2 The LTID shall send out “Calibration Due Notifications” to recall authorities every Monday to recall authority personnel to allow a minimum of 60 days to act on their MTE in accordance with this document.

4.3 The MTE owner shall act on the “Calibration Due Notifications,” before any calibration due date by having the unit removed from recall as allowed by this GLPR, extend the calibration interval, or have it calibrated.

4.3.1 If evidence of actions is in work, no corrective action is necessary.

4.3.2 If no response is received before the calibration due date expires:

- a. The LTID shall review overdue calibration report to investigate and determine appropriate action in accordance with GRC policies and procedures.
- b. Calibration overdue notifications shall be sent before the MTE is due calibration to the recall authority and the next level of management to allow time for resolution.
- c. If the MTE is not submitted for calibration, removed from recall, or the interval extended within the time identified in after the MTE due date, LTID shall generate a CAPA against the nonconforming division.

## APPENDIX A. Definitions

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Acceptance Testing. Test(s) performed to ensure that new MTE meet the specifications defined by the manufacturer or by the contract.

Calibration. The set of operations that establishes under specified conditions, the relationship between values indicated by a measuring or generating instrument and measurement standards.

Calibration Interval. An established period of time for which calibrations are considered valid.

Calibration Label. The label attached to the MTE that identifies the calibration status of the equipment.

Calibration Procedures. The detailed process used in the calibration of MTE against certified calibration standards which include the check method, acceptance criteria, required accuracy, and equipment identification and type.

Calibration Service Provider. Any entity performing calibration service. This can be the Glenn Metrology and Calibration Laboratory (GMCL); a technical contact or user organization; or an off-lab, qualified, third-party calibration laboratory.

Calibration Standard. Measurement reference of known accuracy against which items of unknown accuracy are calibrated. Standards include certified reference materials and intrinsic standards:

Calibration Supplier Quality Survey. Process ensuring that calibration laboratories and calibration suppliers used by NASA customers meet the requirements of NASA-STD-8739.12..

Corrective and Preventative Action (CAPA) System. A Web-based database designed to allow interactive reporting, tracking, and analysis of corrective and preventive actions.

Critical: An event in the any phase of the mission that is time-sensitive and is required to be accomplished successfully in order to achieve mission success.

Due Date. The last day on which the calibration is valid.

Glenn MTE Calibration Management Database. The database maintained by the Logistics and Technical Information Division (LTID), which contains pertinent calibration data. This system provides the method of controlling MTE that affects quality or safety.

Glenn MTE Calibration Management Database Manager. The LTID civil servant or support service contractor responsible for maintaining the Glenn MTE Calibration Management Database.

Historical Data (Record). A record of MTE anomalies, conformance and nonconformance, customer information, and/or equipment adjustments recorded by the calibrating organization.

Impact Analysis (IA). The documented process to validate and determine the significance of using nonconforming MTE to any quality or safety measurement.

In Situ Calibration. An in-place calibration of MTE performed by a calibration service provider.

Inactive (Equipment) Status. Equipment without valid calibration. This equipment cannot be used to make product conformance, quality, and/or safety measurements, unless it is calibrated.

Intrinsic Standard. A standard whose values are inherently derived from the constants of nature or other natural phenomena.

Legacy MTE. Legacy MTE consists of individual devices, and all like items of identical technical description, make, and model that are listed in the GMCL existing MTE register at the effective release date of NPD 8730.1C (June 27, 2011).

Limited Calibration. Calibration that is performed and identified to a limited number of functions or to different specifications from a standard calibration. It can also be used to identify a unique or characterized calibration, the extension of a calibration interval, and mating MTE as a calibration system.

Measurement. The set of operations having the objective of determining the value of a quantity.

Measurement Data. The value of a measured quantity provided by a measurement instrument which can also referred to as the measurand.

Measuring and Test Equipment (MTE). Any device used to perform measurement where distinct values are required for system performance or the measurements are used to demonstrate conformance to specified requirements.

Metrology. The science of measurement.

MTE Technical Contact. The Glenn civil servant or support service contractor employee responsible for responding to the GMCL recall notification and for completing Impact Analysis for OOT conditions.

MTE User. Glenn civil servant and/or support service contractor personnel who use MTE.

National Institute of Standards and Technology (NIST). The government agency responsible for setting and maintaining national measurement standards in the United States.

National Standard. A standard recognized by official national decisions as the basis for fixing the value in a country of all other standards of the quantity concerned. In the United States, national standards are established, maintained, and disseminated by the National Institute of Standards and Technology (NIST).

P-Card Web Solution. An electronic system that enables bankcard users to make government purchases for less than SAP requirements. P-Card interfaces with SAP to commit and obligate funds.

Product. For this document, a product is any deliverable, including hardware, software, data, and other documentation.

Project Authority. The project or program manager, responsible engineer, technical manager who has the authority to assume responsibility for recall, IA, and ensuring compliance to this document.

Qualified Calibration Service Provider List. List of service providers maintained in the GMCL that have been approved through the calibration supplier quality process.

Quality and/or Safety MTE. Measuring and test equipment used to measure or generate known values for compliance to functions and conditions requiring measurement controls as identified in Section 1.2.

Recall. Recall is the process that requires equipment to be calibrated when it is due calibration. This is required for quality and safety MTE unless it is excluded because it was not used. The GMCL shall be notified if quality and safety equipment was not used to remove from recall.

Reference Standard. A standard generally of the highest metrological quality available from which all other measurements are derived. It is typically one echelon below the national standards maintained by NIST.

Responsible Engineer. Engineer or researcher that oversees the operations in which the MTE was used. In the case when the MTE technical contact is the person overseeing the operations, then the technical contact's Supervisor assigns a person from their organization as the Responsible Engineer.

Safety. Safety is the conduct and management of research and development operations in such a manner as to:

- a. Eliminate and/or reduce potential hazards and prevent accidents involving injury to personnel.
- b. Minimize all hazards involving damage to property or loss of research operating time.

SAP Business Management Software. An electronic system developed to transmit a defined procurement requirement to the final person or organization ultimately responsible for accomplishing that acquisition. The SAP defines the appropriate purchase requisition routing and electronically obtains all necessary reviews, approvals, notifications, and fund certifications.

Tag. The equipment control number or metrology tracking tag that has an identifying number unique to that specific piece of equipment.

Test Software. Software used to control MTE for the acquisition of measurement data.



Third-party Calibration Supplier. Calibration service provider that is not located on LF and PBS.

Transfer Standard. A standard used as an intermediary to compare standards, material measures, or measuring instruments.

Valid Calibration (status). MTE that is within its calibration cycle.

Working Standard. A standard that is usually calibrated against a transfer standard and is used routinely to calibrate or check material measures or measuring instruments.

## APPENDIX B. Acronyms

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ANSI/NCSL	American National Standards Institute/National Conference of Standards Laboratories
AS	Aerospace Standards
ATF	Armstrong Test Facility
BMS	Business Management System
CAP	Corrective Action Plans
CAPA	Corrective and Preventive Action
CPAR System	Corrective and Preventative Action Reporting System
GCL	Glenn Calibration Laboratory, aka GMCL
GMCL	Glenn Metrology and Calibration Laboratory
GLID	Glenn Interim Directive
GLPR	Glenn Procedural Requirements
GLWI	Glenn Work Instructions
GRC	Glenn Research Center
HDBK	Handbook
IA	Impact Analysis
LF	Lewis Field
LTID	Logistics and Technical Information Division
MTE	Measuring and Test Equipment
NIST	National Institute of Standards and Technology
OOT	Out-Of-Tolerance
Q&S	Quality and Safety
QMS	Quality Management System
SMA	Safety and Mission Assurance Directorate
SAP	Systems, Applications, and Products

## **APPENDIX C. Records**

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C.1 Calibration Labels: See Chapter 2 for label types

C.2 Calibration Lab Calibration Due Notice

C.3 Calibration Lab Calibration Overdue Notice

C.4 Calibration records (certificates, data)

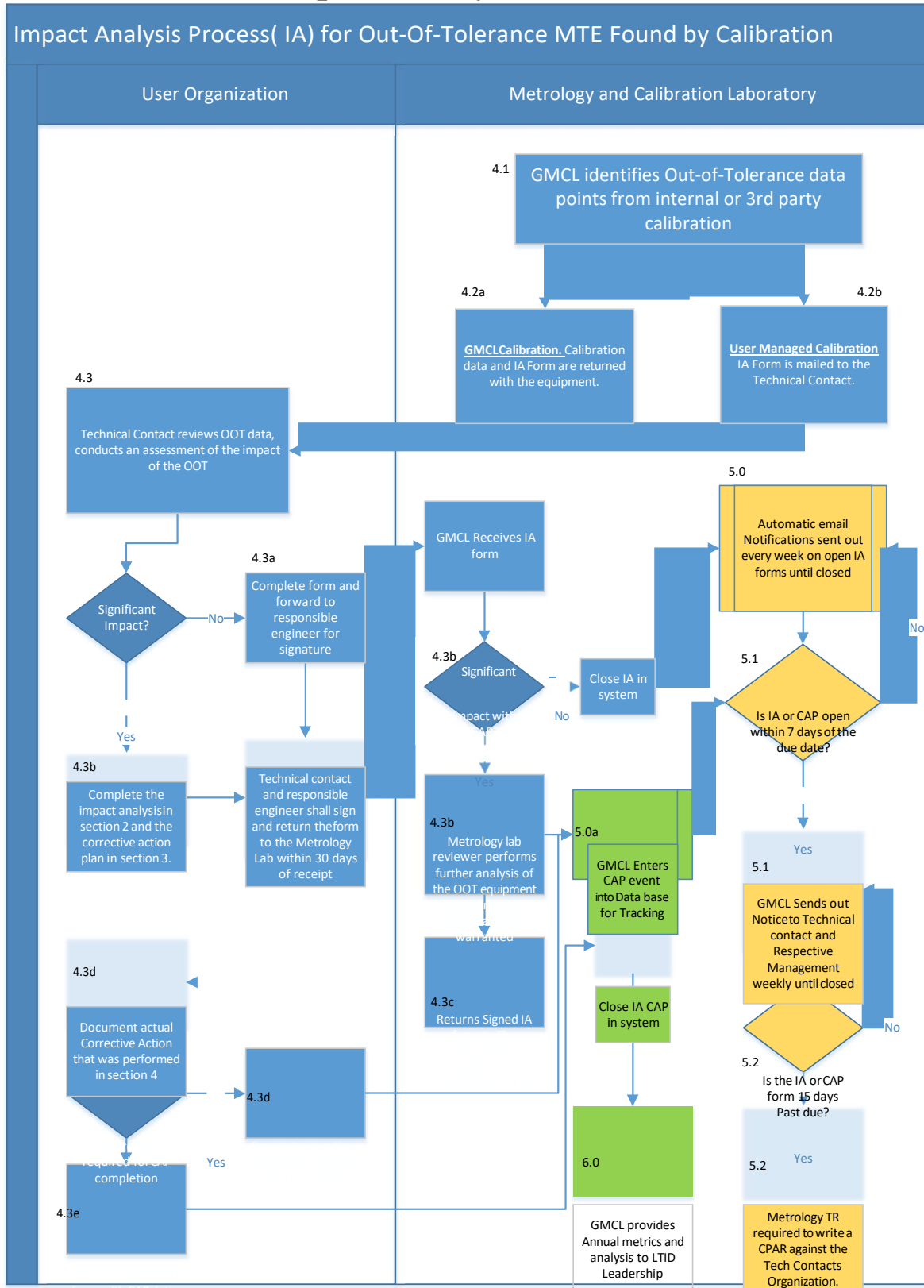
C.5 Fluke Met/Team Calibration Management Software (management database)

C.6 Form GRC 57, Calibration Interval Change Request

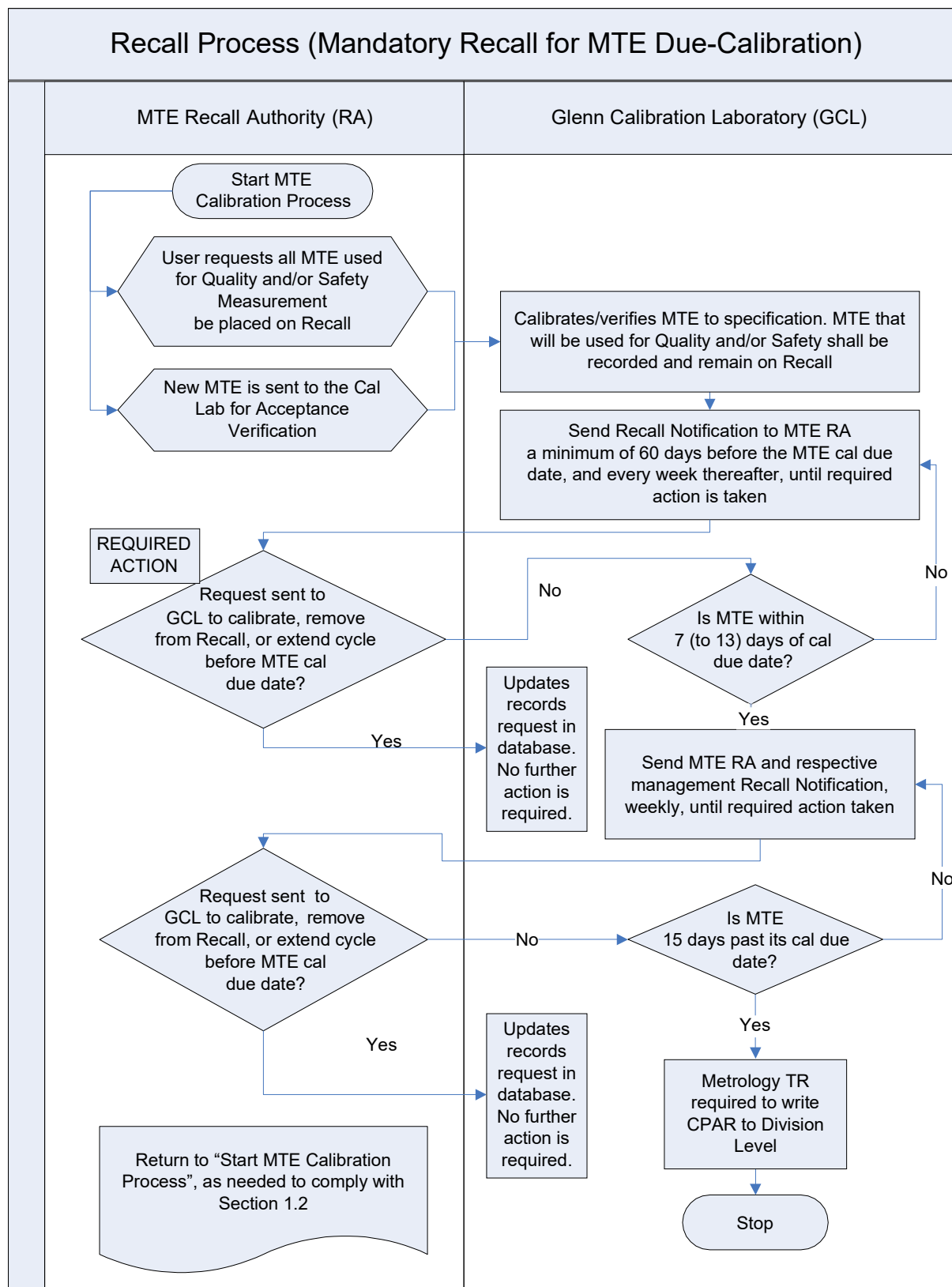
C.7 Form GRC 282, Out-of-Tolerance Impact Analysis

C.8 Records identifying MTE that affect quality and/or safety

## APPENDIX D. Impact Analysis Flowchart for OOT



## APPENDIX E. Recall Process



### Change History

Change	Date	Description/Comments
Basic	3/30/2007	Document converted from CLP (GRC-P3.11.1) to GLPR
A	7/18/2007	Adding AS9100 requirements and general editing
B	12/3/2007	Minor updates to P.4 and Chapters 1, 2 and 5
C	10/28/2011	Major realignment and clarification of responsibilities and impact analysis process to align to NPD 8730.1C, ISO9001 and AS9100 requirements. Added Out-of-Tolerance Impact Analysis process.
D	3/28/2014	Alignment to updated Center practices regarding the Recall and Impact Analysis processes. Improved clarity and reduced redundancy. Added content to 1.4, 1.5, 1.14.4, 1.14.5, updated Chapter 4 and 5.
E	5/12/2016	Updated to reflect new terminology associated with the updated IA process. Updated the IA process and flow map. Reformatted appendices. Minor text spacing fixes.
F	5/10/2021	Corrected multiple entries of obsolete NPD. Updated to meet requirements of GLPR 1410.1 Moved Chapter 3 list of records to Appendix C CAB-012 Impact Analysis Form changed to GRC 282 Form, Out-of-Tolerance Impact Analysis; process updated accordingly
Change 1	07/06/2022	Administrative Changes: Replaced former reference authority document, NPD 8730.5 with NPR 8735.2; removed all references to ANSI/NCSL Z540.1 and Z5403.4